

# ANATOMY AND HISTOLOGY OF LIVER & SPLEEN



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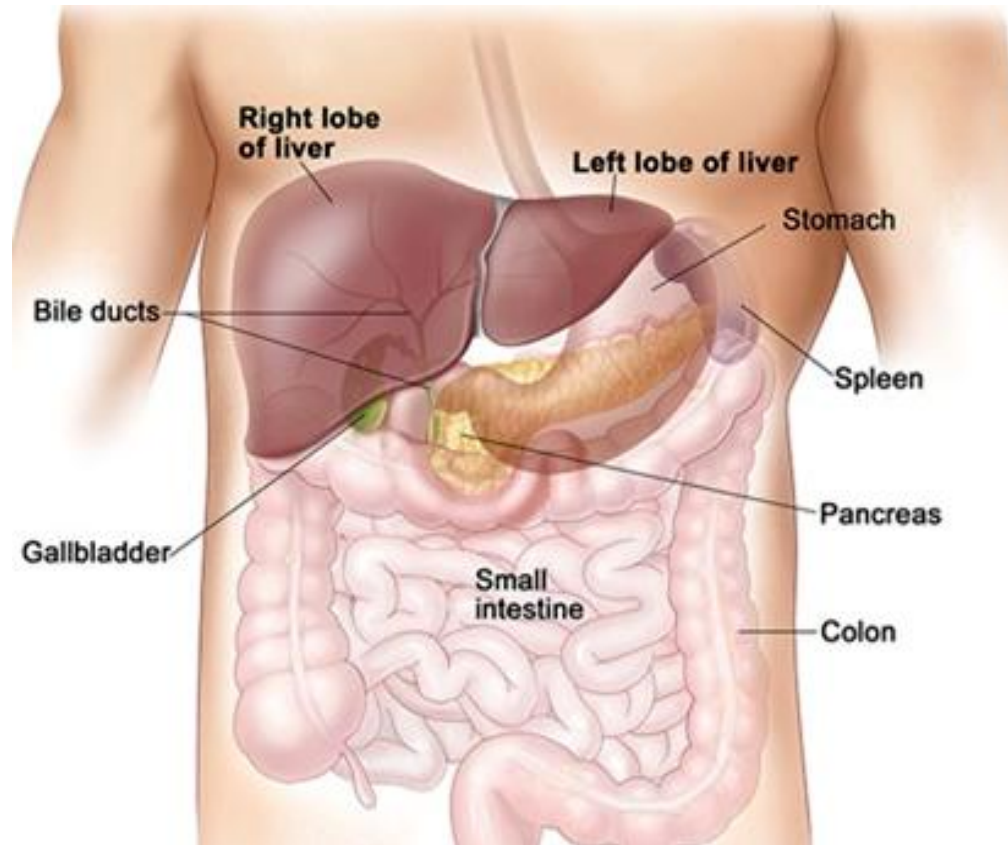
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# **Learning Objectives**

Students should be able to;

- Describe the anatomical position of Liver within the abdominal cavity.
- Describe the surfaces of liver along with their relations.
- Enlist the names of ligaments attached upon the liver.
- Differentiate between the anatomical & functional lobes of liver .
- Describe the blood supply of liver.
- Describe the microscopic features of a 'typical hepatic lobule'.
- Describe the anatomical features of Spleen.
- Describe the microscopic anatomy of Splenic pulp.

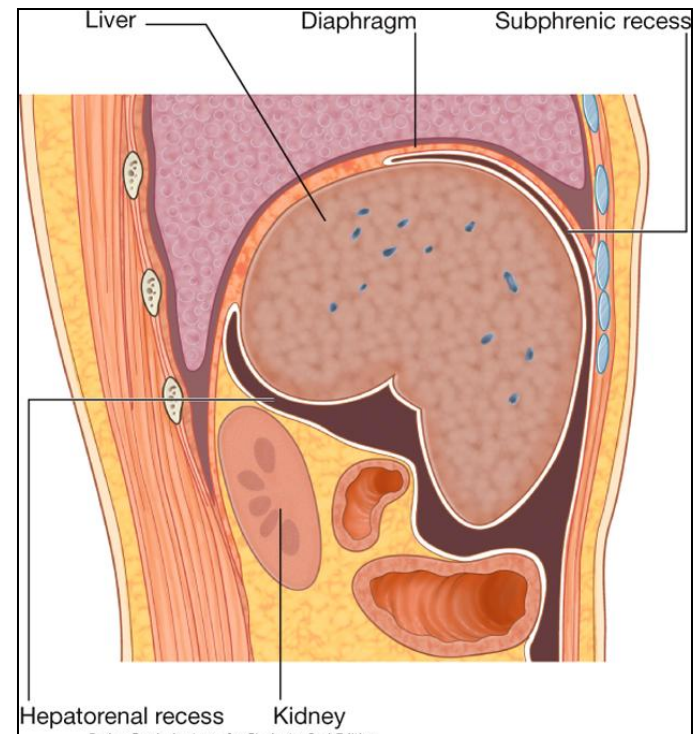
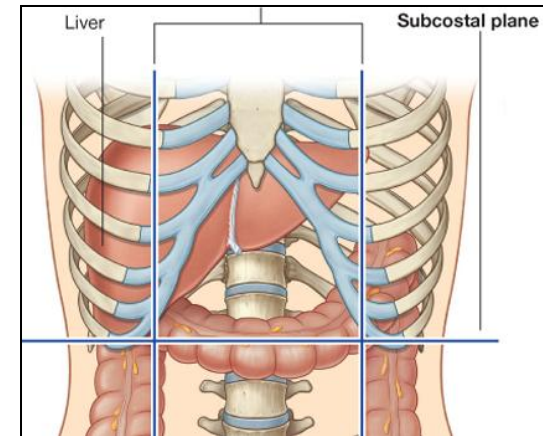
# The Liver



- An organ in the upper abdomen that aids in digestion and remove waste products and worn-out cells from the blood. It is the largest glandular organ in the body.

# Position of the Liver

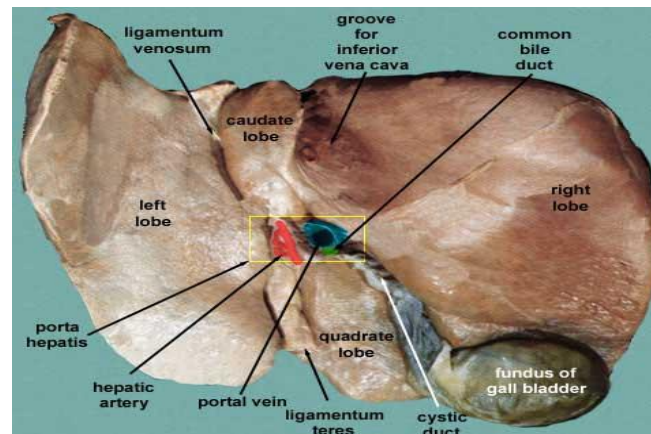
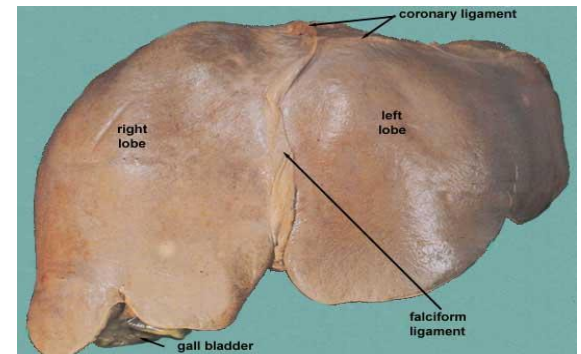
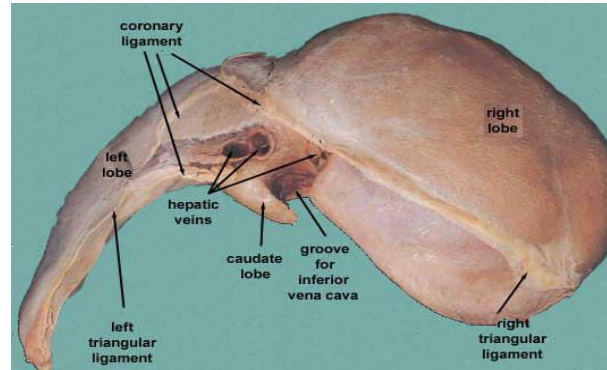
- Occupies the entire right hypochondrium ( $5^{th} - 10^{th}$  intercostal space) and epigastrium.
- Covered by the right dome & central tendon of diaphragm.
- Completely covered by peritoneum (except for the 'bare area')



# Surfaces of Liver

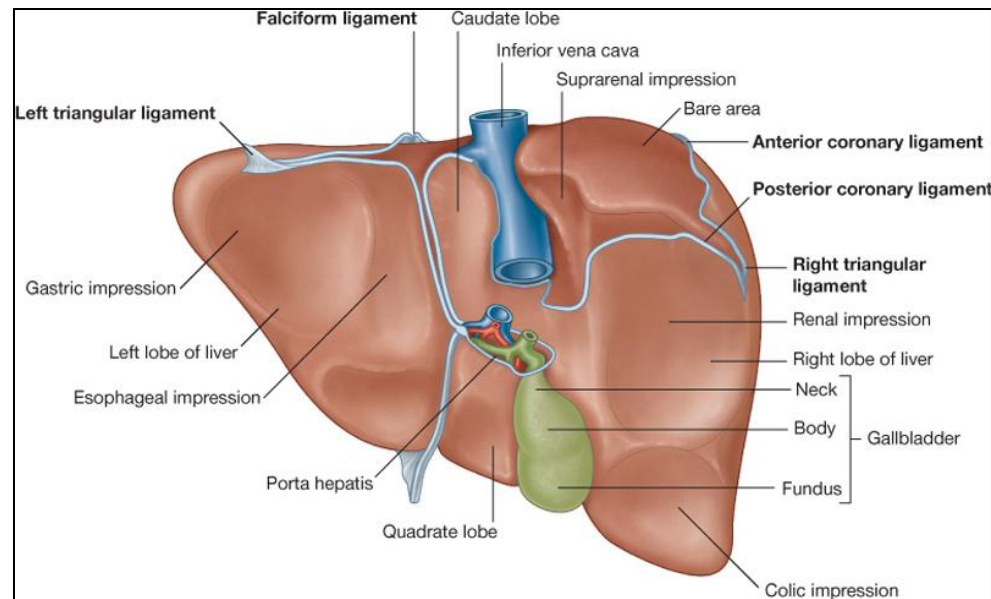
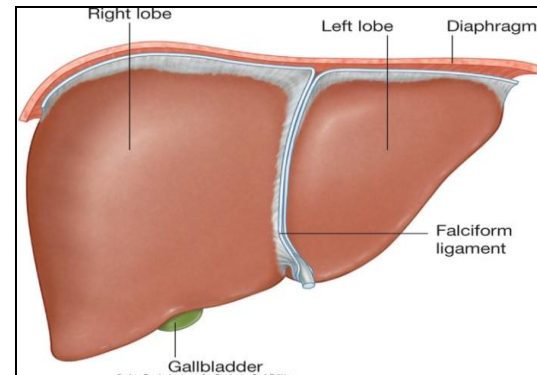
Three surfaces;

- **Superior / Diaphragmatic surface**
- **Anterior / Abdominal surface**
- **Inferior / Visceral surface**



# Ligaments of the Liver

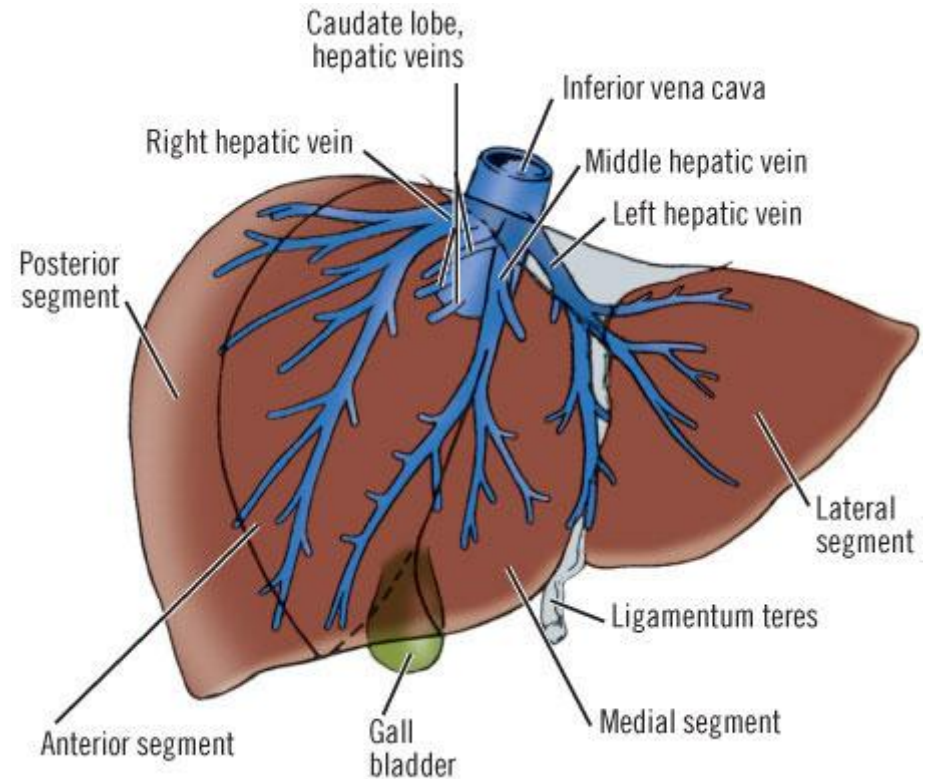
- **Falciform ligament:** a fold of ventral mesentery running b/w the anterosuperior surface of liver & anterior abdominal wall.
- **Ligamentum teres:** obliterated left umbilical vein running in the fold of falciform lig.
- **Right & left Triangular ligaments:** at the corners of the liver connecting the superior surface to the diaphragm.
- **Ant & Post Coronary ligaments:** reflected edges of peritoneum, encircling the 'bare area' of liver.
- **Ligamentum venosum:** obliterated ductus venosus, marking the visceral surface of liver.





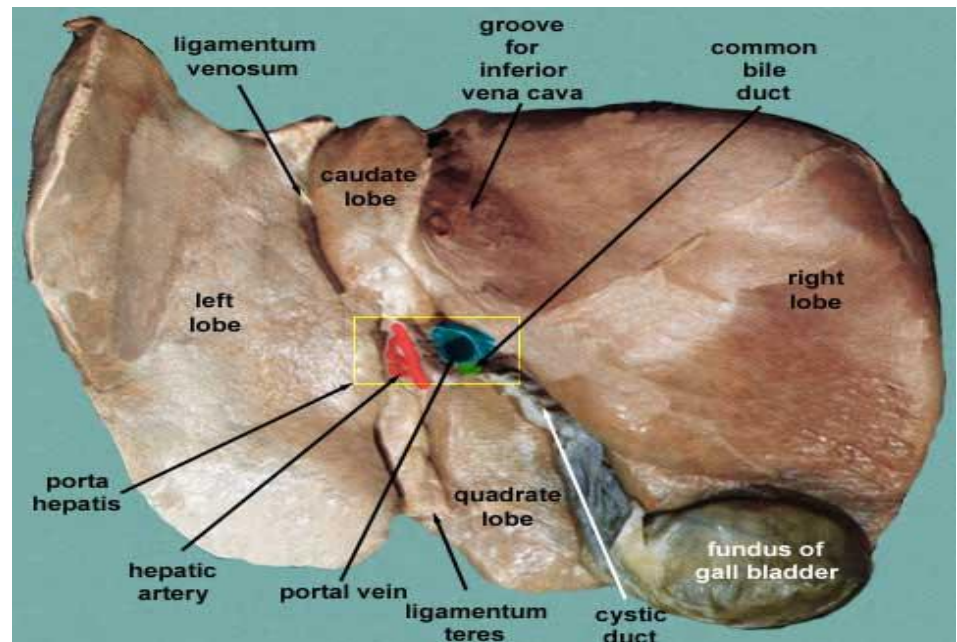
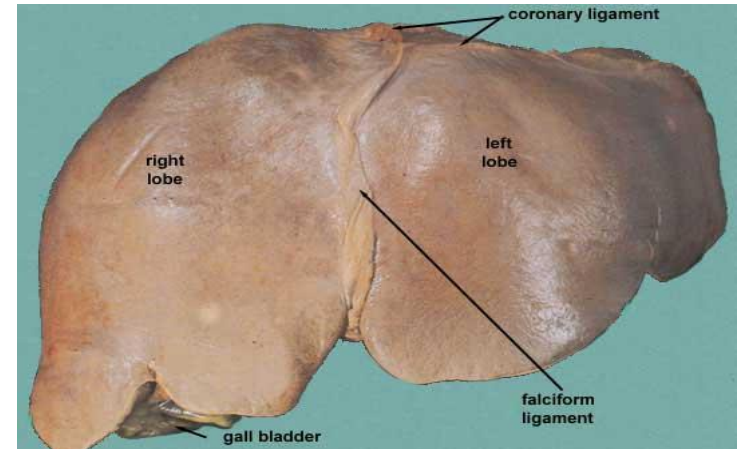
# Supports of Liver

- None of the ligaments give any true support to the Liver. The Liver is kept in place by the upward push of abdominal viscera. The only anchoring support for the Liver is by the 3 '**Hepatic veins**' which open up into IVC.
- *One can not remove the liver from the abdomen without cutting the connection of these veins with IVC.*



# Anatomical lobes of Liver

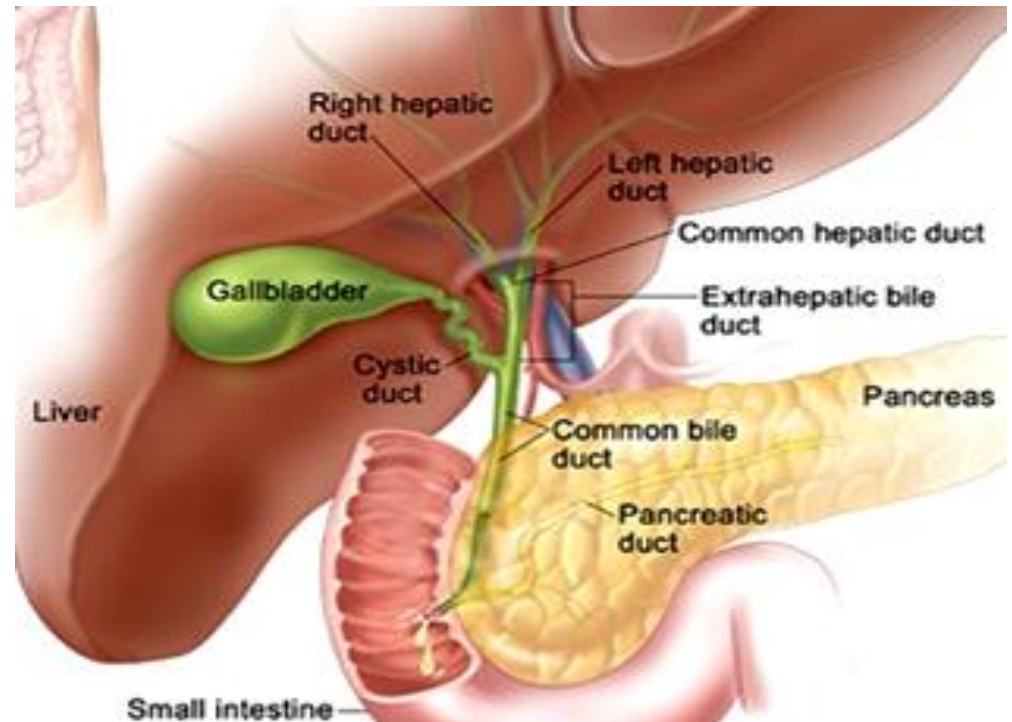
- Anteriorly, falciform ligament divides the surface into a;
  - **Right lobe** (larger)
  - **Left lobe** (smaller)
- Inferiorly, ligamentum venosum, IVC groove, ligamentum teres, & gall bladder fossa divide the surface into a;
  - **Caudate lobe**
  - **Quadrate lobe.**





# Arrangement of structures in the '*porta hepatis*'

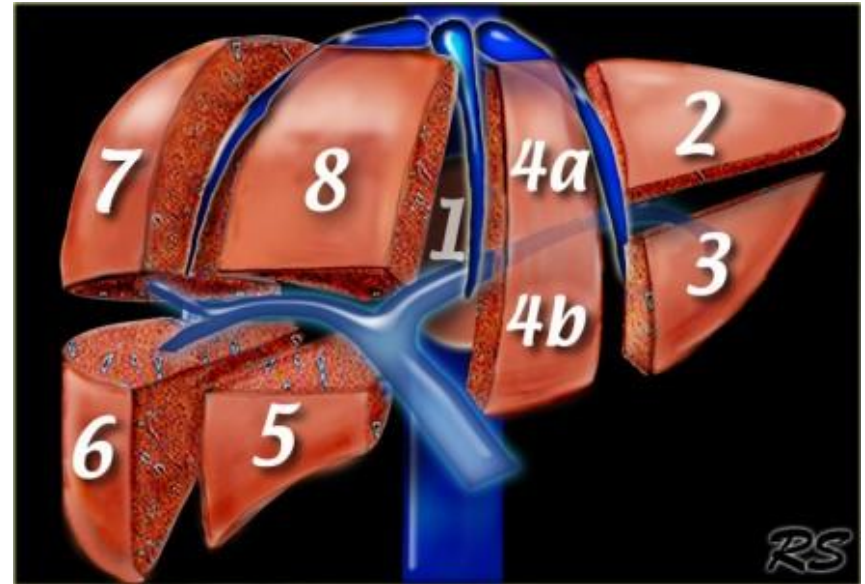
- Anterior to posterior;
  - Bile duct
  - Hepatic artery
  - Portal vein



# Functional division of the lobes of Liver

## (Couinaud classification)

- Divides the liver into eight functionally independent segments. Each segment has its own vascular inflow, outflow and biliary drainage.
  - **Right hepatic vein** divides the right lobe into anterior and posterior segments.
  - **Middle hepatic vein** divides the liver into right and left lobes.
  - **Left hepatic vein** divides the left lobe into a medial and lateral part.
  - **Portal vein** divides the liver into upper and lower segments.



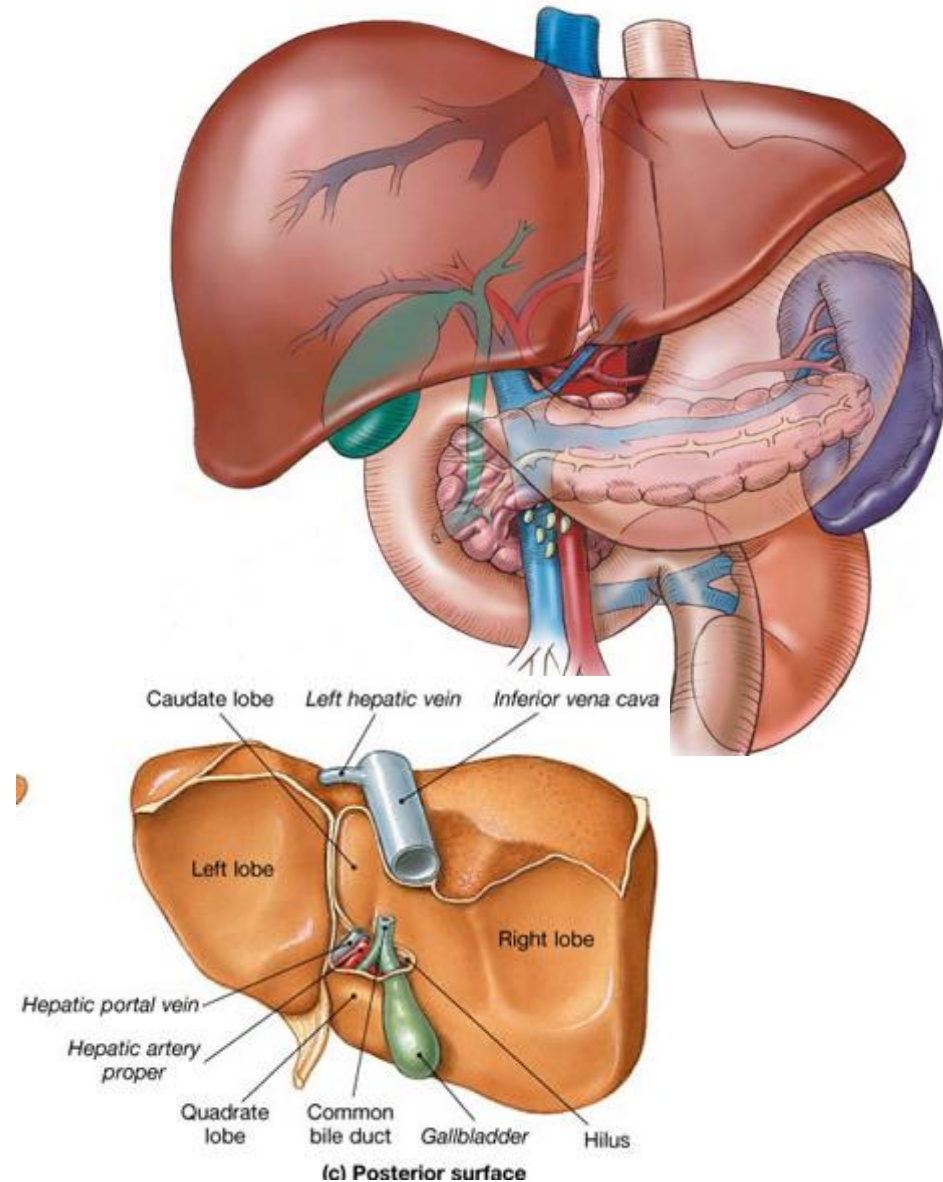
# Clinical significance of the functional division of liver

- In order to perform segmental or sub segmental resection , the surgeon must know exactly which parts of the liver are diseased so that vascular supply and biliary drainage of the healthy segments can be preserved.
- Because of this division into self-contained units, each segment can be resected without damaging the others.

*Each segment has its own branch of Portal venule, hepatic arteriole, and Bile ductule.*

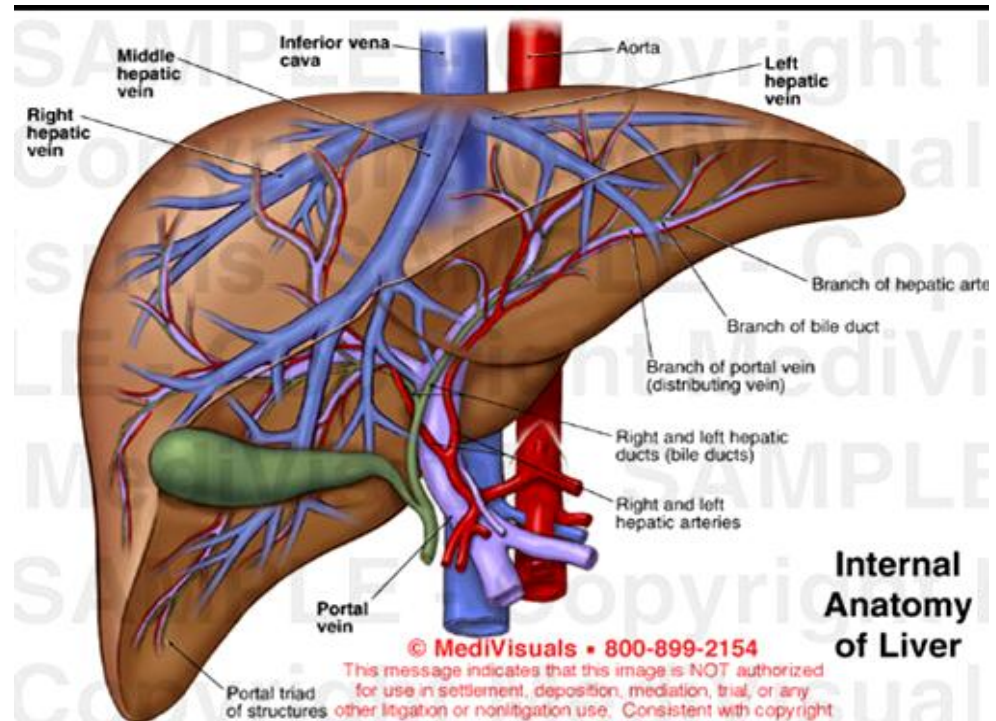
# Important Relations of the Liver

- Left lobe- fundus of stomach, lesser curvature + lesser omentum
- Caudate lobe- Inferior vena cava
- Quadrate lobe- Gall bladder
- Right lobe- Hepatic flexure, upper pole of right kidney.



# Blood supply of the Liver

- Receives a dual blood supply.
- 70% of supply is by Portal vein (oxygen poor nutrient-rich blood)
- 30% of supply is by Hepatic artery proper (oxygen-rich blood)
- Both Portal vein & Hepatic artery enter the liver through Porta hepatis & divide into right & left branches to supply all the lobes of liver.



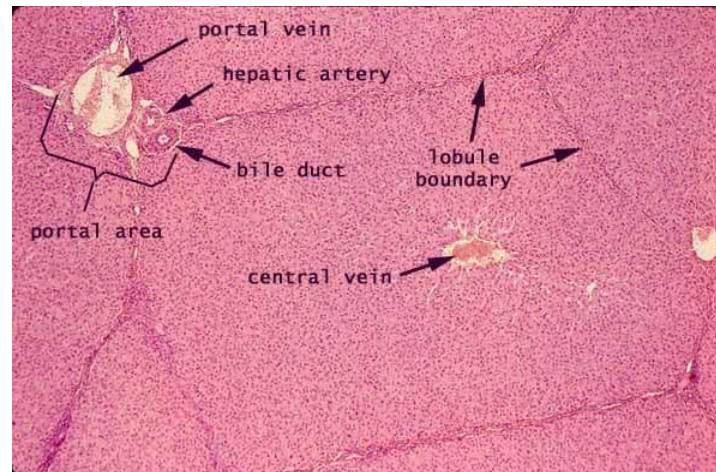
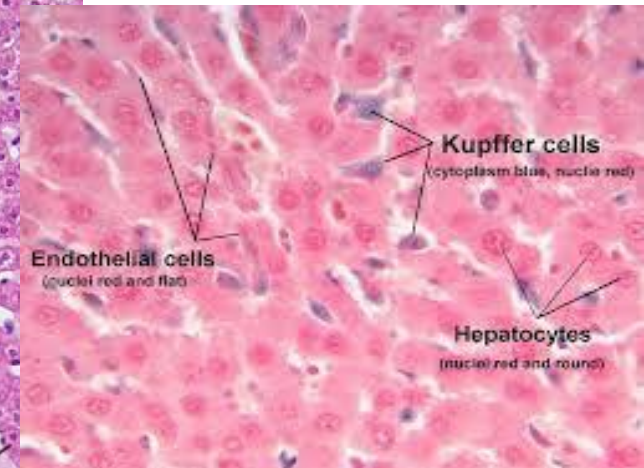
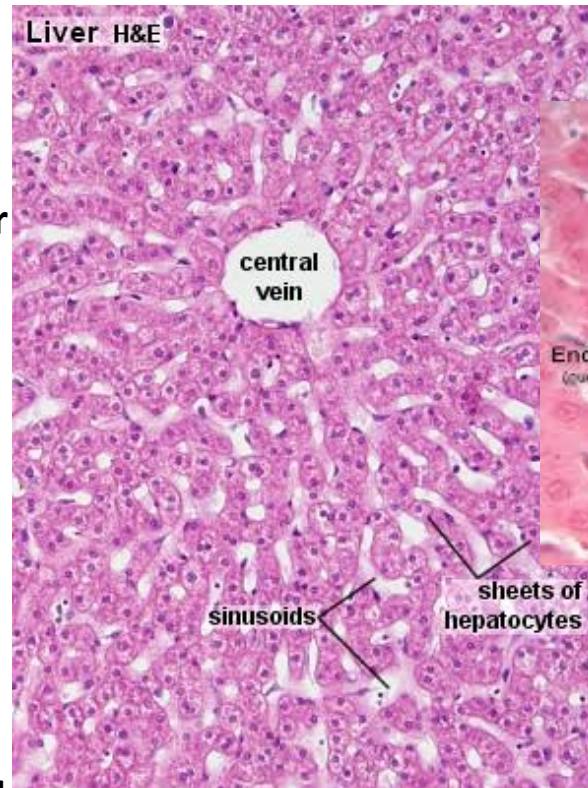


## Blood supply cont'd

- Right branch of **Portal vein** + **hepatic artery** supply only the *right lobe*.
- Left branch of **PV** + **HA** supply the *left lobe, caudate lobe, & quadrate lobe*.
- **Left hepatic vein** drains the *left lobe*
- **Middle hepatic vein** drains the *caudate & quadrate lobes*.
- **Right hepatic vein** drains *right lobe*.

# Histology of Liver

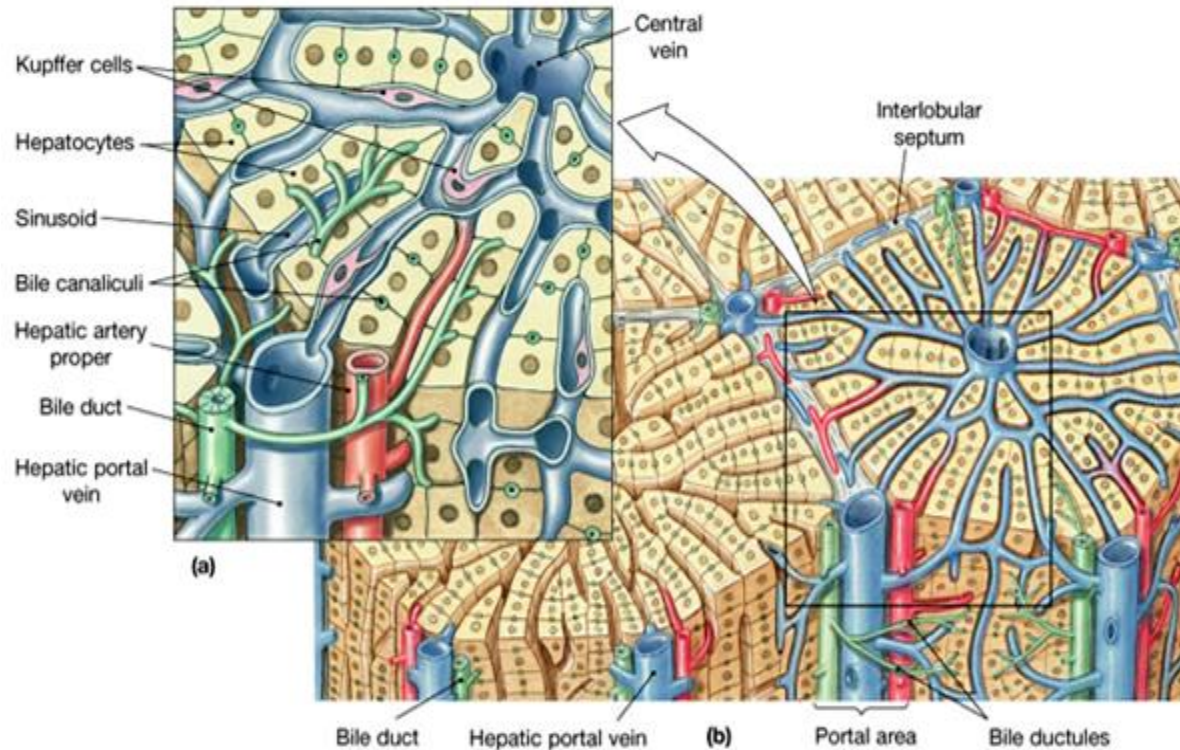
- Hepatocytes form series of irregular plates
- Plates are only one cell thick
- Are arranged like spokes of a wheel
- Sinusoids run b/w the plates & open into a central vein
- Sinusoids are lined with endothelial cells & a large number of phagocytic cells, the *Kupffer cells*.
- Kupffer cells engulf pathogens, cell debris, & damaged blood cells.



# Architecture of a typical Hepatic lobule

- A typical liver lobule has a hexagonal shape in cross section. There are six portal areas, or hepatic triads, one at each corner of the lobule. A portal area contains three structures:

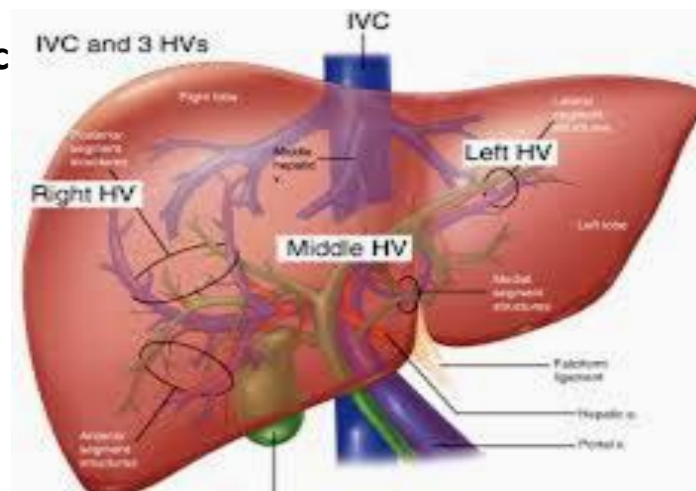
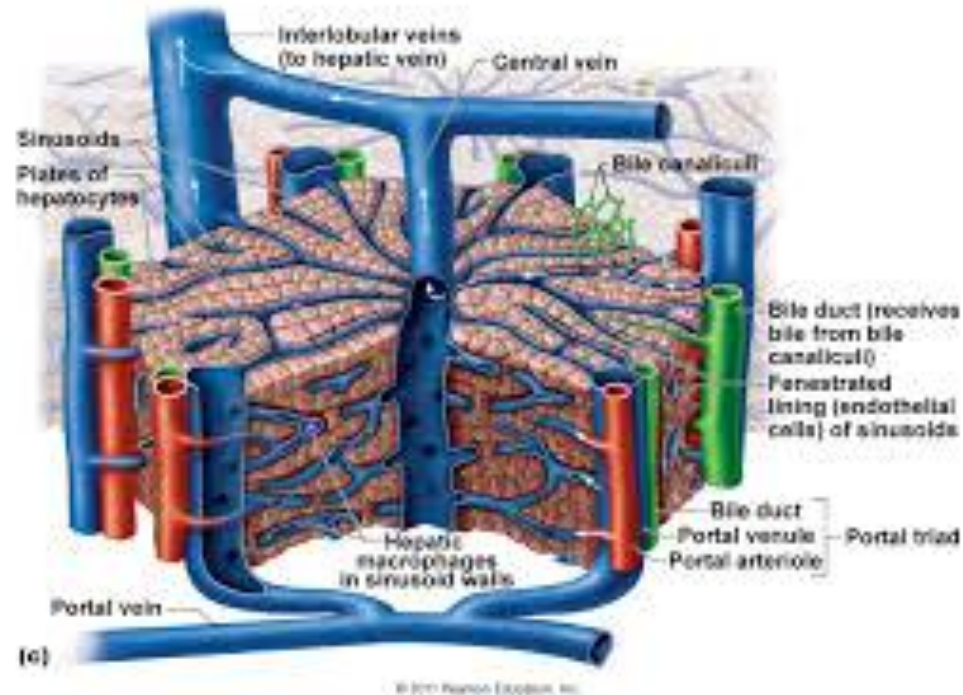
- (1) a branch of the hepatic portal vein,
- (2) a branch of the hepatic artery,
- (3) a small branch of bile duct



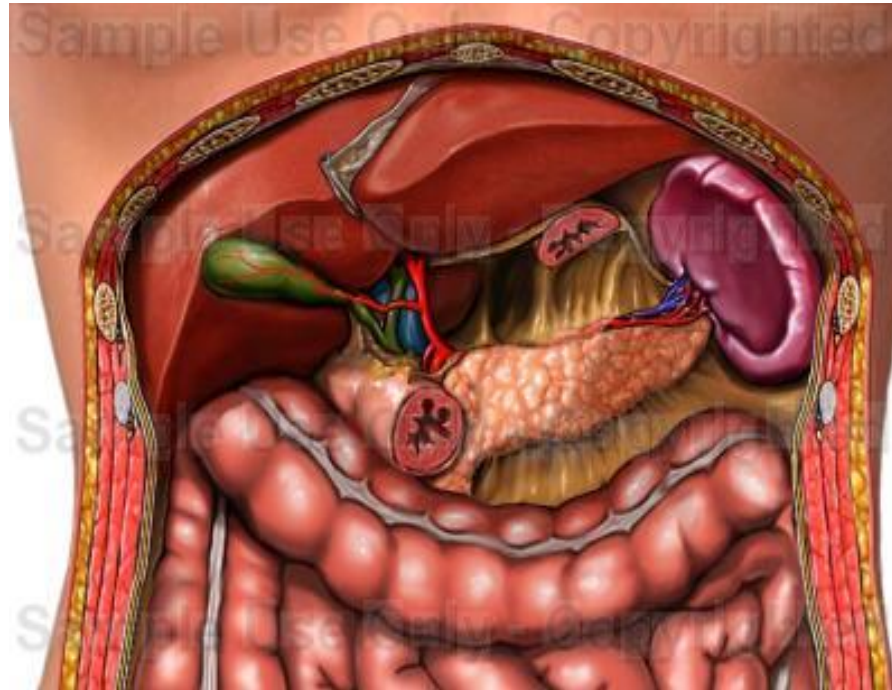


# Blood flow through Hepatic tissue

- **Portal venule**  
↓
- **Hepatic sinusoids**  
↓
- **Uptake of nutrients (by Hepatocytes)**  
↓
- deoxygenated blood dumped into **Central vein**  
↓
- Central veins open into **interlobular vein**  
↓
- Interlobular veins open into **Hepatic veins**  
↓
- 3 Hepatic veins open into **Inferior Vena Cava**



# Anatomy of Spleen



- Spleen is a solid organ
- Roughly the size of a fist
- A retro-peritoneal lymphoid organ
- Receives almost 25% of the total blood circulation.
- Lying behind the fundus of stomach.



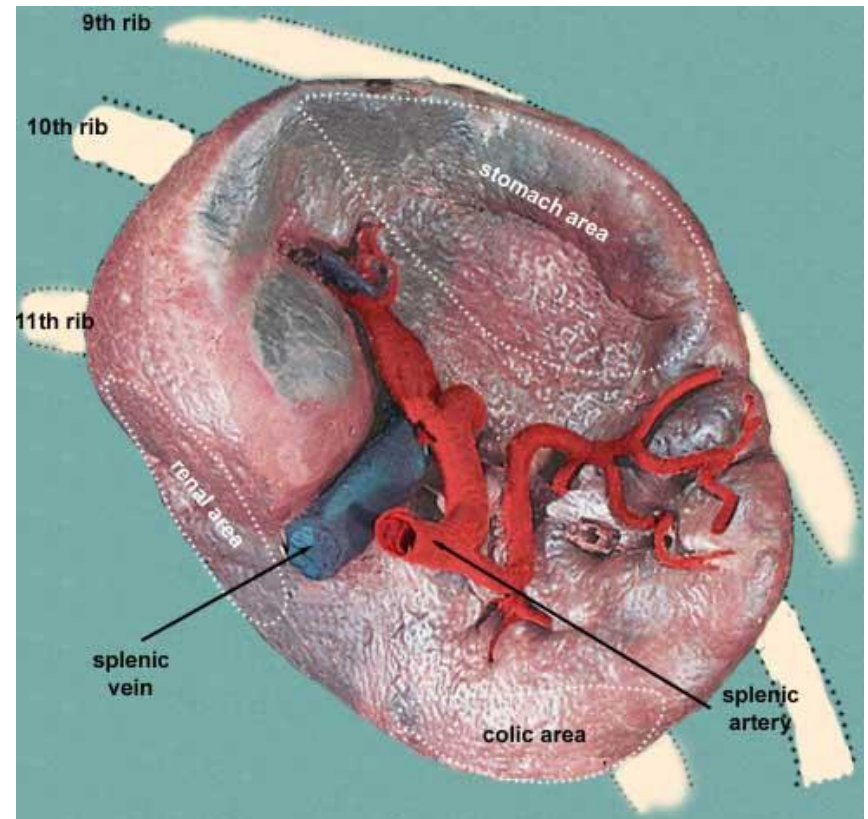
## Why is the spleen considered a part of digestive system, even though functionally it is not?

*Due to close proximity, and shared blood supply.*

The spleen is unique in respect to its development within the gut. While most of the gut viscera are endodermally derived , the spleen is derived from mesenchymal tissue. Specifically, the spleen forms within, and from, the dorsal mesentery. However, it still shares the same blood supply—the celiac trunk—as the foregut organs.

- The spleen varies in size and shape between people, but it's commonly fist-shaped, purple, and about 4 inches long. Because the spleen is protected by the rib cage, you can't easily feel it unless it's abnormally enlarged.

- Receives its blood supply from the 'short gastric arteries' and 'splenic artery'
- Drained by a single splenic vein.



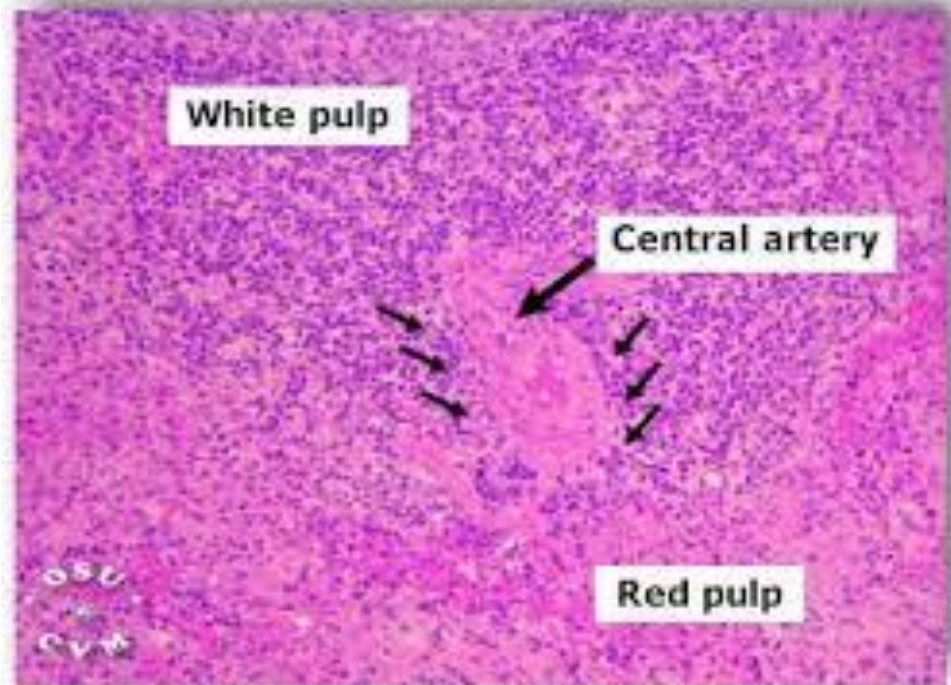
# Cross-sectional appearance of Spleen

- Externally covered by a fibrous capsule.
- The internal components are collectively called "*pulp*".
- On gross examination, the pulp has two very different appearances: **red** and **white**.
- The organ appears as a large expanse of red pulp dotted with white pulp.



# Histology of Spleen

- Histologically, red pulp is "red" due to the presence of large numbers of erythrocytes in blood vessels called sinuses and white pulp is "white" due to lack of these sinuses and consequently fewer erythrocytes.
- The red pulp surrounds the white pulp while the latter looks like lymphatic nodules. Closer inspection of the white pulp indicates that there is a "central arteriole", sometimes called a central artery, close to the center of each area of white pulp.



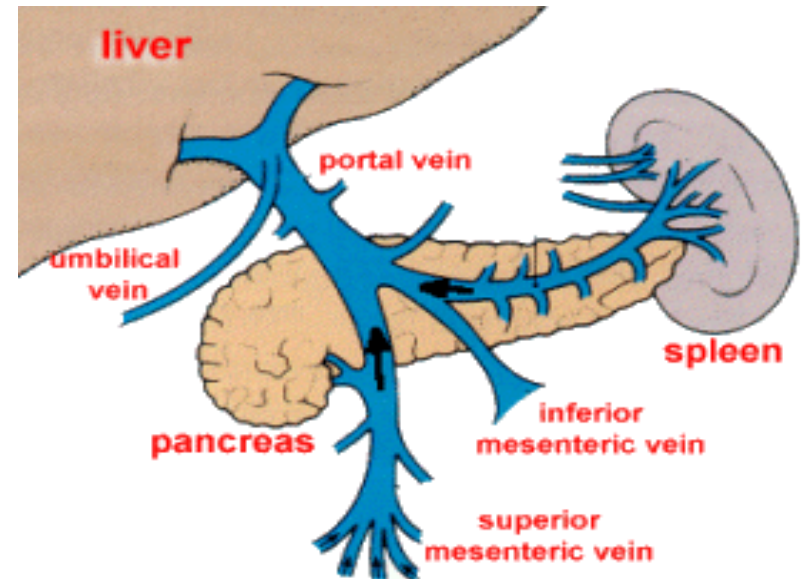


## **Clinical correlation**

- The spleen is vulnerable to injury, and a ruptured spleen can cause serious life-threatening internal bleeding and is a life-threatening emergency. An injured spleen may rupture immediately after an injury, or in some cases, days or weeks after an injury.
- (Splenomegaly): An enlarged spleen, usually caused by viral mononucleosis (“mono”), liver disease, blood cancers (lymphoma and leukemia), or other conditions.

# Portal vein and its tributaries

- A small venous channel entering the porta hepatis along with the Hepatic artery & Bile duct.
- Formed behind the head of Pancreas by the union of;
- Superior mesenteric vein + Splenic vein
- Tributaries of Portal vein:
  - Inferior mesenteric
  - Gastric veins
  - Cystic
  - Superior mesenteric
  - Splenic



# Porto-systemic anastomosis

- At the gastroesophageal junction b/w branches of Azygos & left gastric veins
- At the upper end of Rectum b/w superior rectal vein & middle & inferior rectal veins
- Around paraumbilical region b/w paraumbilical & superficial epigastric veins.

